

WHAT IS CLAIMED IS:

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5 7 5
1. A catheter for controlling blood flow to a branch vessel of a blood vessel, comprising:

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a) an elongated shaft;
b) a tubular member on a distal section of the shaft having an interior passageway which is radially expandable within a blood vessel to separate blood flow through the blood vessel into an outer blood flow stream exterior to the tubular member and an inner blood flow stream within the interior passageway of the tubular member, and which is configured to extend within the blood vessel upstream and downstream of a branch vessel; and

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c) a radially expandable member on the tubular member, having an expanded configuration with an outer diameter larger than an outer diameter of the tubular member and which is configured to direct at least part of the blood flow in the outer blood flow stream into the branch vessel.

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2. The catheter of claim 1 wherein the elongated shaft has at least one lumen therein in fluid communication with at least one agent delivery port in a distal section of the shaft, and wherein the radially expandable member is downstream of the agent delivery port.

3. The catheter of claim 2 wherein the tubular member has an upstream end located upstream of the agent delivery port.

4. The catheter of claim 2 wherein the tubular member has a distal end located distal to the agent delivery port.

5. The catheter of claim 2 wherein the agent delivery port is a lateral port in a side wall of the shaft.

5 6. The catheter of claim 1 wherein the radially expandable member comprises an inflatable balloon, and the shaft includes an inflation lumen and an inflation port in fluid communication with an interior of the balloon.

7. The catheter of claim 1 wherein the radially expandable member comprises a radially enlarged section of the tubular member.

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12. The catheter of claim 10 wherein the tubular member comprises a sheet configured to unwind from a wound low profile configuration to an unwound radially expanded configuration to thereby radially expand the interior passageway of the tubular member.

5 13. The catheter of claim 1 wherein the tubular member comprises a plurality of tubular balloons joined together, each tubular balloon being joined to adjacent tubular balloons along a length thereof to thereby define the tubular member interior passageway.

10 14. The catheter of claim 1 wherein the tubular member is conically shaped having a smaller diameter end and a larger diameter end

15 15. The catheter of claim 14 wherein the radially expandable member is formed by the larger diameter end of the conical tubular member.

16. The catheter of claim 1 wherein the interior passageway of the tubular member has an expanded inner diameter of about 30 mm to about 130 mm.

17. The catheter of claim 1 wherein the interior passageway of the tubular member has an unexpanded inner diameter configured to expand to an expanded inner diameter, wherein the expanded inner diameter is about 1000% to about 6000% larger than the unexpanded inner diameter.

18. A method of controlling blood flow to a branch vessel of a blood vessel, comprising:

a) providing a catheter comprising

i) an elongated shaft;

5 ii) a tubular member on the distal section of the shaft having an interior passageway which is radially expandable within a blood vessel, and which is configured to extend within the blood vessel upstream and downstream of a branch vessel; and

10 iii) a radially expandable member on the tubular member, having an expanded configuration with an outer diameter larger than an outer diameter of the tubular member and which is configured to decrease the blood flow in the outer blood flow stream downstream of the branch vessel; and

15 b) advancing a distal portion of the catheter within the patient's descending aorta, so that an upstream end of the tubular member is upstream of the branch vessel and the radially expandable member is downstream of the branch vessel;

20 c) expanding the tubular member to separate blood flow through the blood vessel into an outer blood flow stream exterior to the tubular member and an inner blood flow stream within the interior passageway of the tubular member; and

d) expanding the radially expandable member to the expanded configuration to thereby decrease the blood flow in the outer blood flow stream downstream of the at least one renal artery.

19. The method of claim 18 including expanding the radially expandable member into contact with a wall of the blood vessel to occlude the outer blood flow stream downstream of the branch vessel.

20. The method of claim 18 including expanding the radially expandable member to an outer diameter which does not completely occlude the outer blood flow stream downstream of the branch vessel.

21. A catheter for delivering a therapeutic or diagnostic agent to a branch vessel of a blood vessel, comprising:

a) an elongated shaft having at least one lumen therein in fluid communication with at least one agent delivery port in a distal section of the shaft;

b) a tubular member on the distal section of the shaft having an interior passageway which is radially expandable within a blood vessel to separate blood flow through the blood vessel into an outer blood flow stream exterior to the tubular member and an inner blood flow stream within the interior passageway of the tubular member, and which is configured to extend within the blood vessel upstream and downstream of a branch vessel; and

c) a radially expandable member on the tubular member, downstream of the shaft agent delivery port, having an expanded configuration with an outer diameter larger than an outer diameter of the tubular member and which is configured to decrease the blood flow in the outer blood flow stream downstream of the branch vessel.

22. A method of delivering a therapeutic or diagnostic agent to a patient's kidney, comprising:

a) providing a catheter comprising

5 i) an elongated shaft having at least one lumen therein in fluid communication with at least one agent delivery port in a distal section of the shaft;

10 ii) a tubular member on the distal section of the shaft having an interior passageway which is radially expandable within a blood vessel, and which is configured to extend within the blood vessel upstream and downstream of a branch vessel; and

15 iii) a radially expandable member on the tubular member, downstream of the shaft agent delivery port, having an expanded configuration with an outer diameter larger than an outer diameter of the tubular member and which is configured to decrease the blood flow in the outer blood flow stream downstream of the branch vessel; and

20 b) advancing a distal portion of the catheter within the patient's descending aorta so that the agent delivery port is upstream or adjacent to at least one renal artery of the patient, and the radially expandable member is downstream of the at least one renal artery;

c) expanding the tubular member to separate blood flow through the descending aorta into an outer blood flow stream exterior to the

tubular member and an inner blood flow stream within the interior passageway of the tubular member;

- 5 d) expanding the radially expandable member to the expanded configuration to thereby decrease the blood flow in the outer blood flow stream downstream of the at least one renal artery; and

e) flowing a therapeutic or diagnostic agent from the shaft lumen to the agent delivery port and into the outer blood flow stream in the aorta, to deliver the therapeutic or diagnostic agent to the at least one renal artery.